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Our Docket No. 8E07.1-070 Patents

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Darin M. Janoschka

Serial No.: **10/652,657**

Filed: **August 28, 2003**

For: **Wiper-Type Phase Shifter With Cantilever Shoe and Dual-Polarization Antenna With Commonly Driven Phase Shifters**

Art Unit: **2821**

Examiner: **Jimmy T. Vu**

RESPONSE TO OFFICIAL ACTION DATED JANUARY 24, 2006

Commissioner for Patents
Mail Stop Fee Amendment
P.O. Box 1450
Alexandria, VA 22313-1450

April 24, 2006

Customer No. 35,725

Sir:

REMARKS

In response to the Official Action dated January 24, 2006, please consider the concurrently filed amendment and the following remarks. Claims 1-28 were present in the application as originally filed, claims 1-11 were elected for examination following a Restriction Requirement, and these claims have now been examined. Claim 1 stands rejected under 35 U.S.C. 102 as allegedly anticipated by Livingston, US 6,388,631, and claims 2-11 are objected to but indicated as allowable. In response, claim 1 has been amended to more clearly distinguish the claimed invention over Livingston and new claims 29-37, which are directed to the elected subject matter, have been entered.

I hereby certify that this correspondence is being filed with the United States Patent and Trademark Office, Patents by U.S. mail with sufficient postage as first class mail to the address shown above or by facsimile directed to the Central Fax No. (571) 273-8300 on the date shown below.

Michael J. Mehrman. Reg. No. 40,086 4-24-2006 Date

As shown in FIG. 1, the beam former disclosed in Livingston utilizes a series of closely-spaced RF MEMS switches to control the delivery of RF energy to a slot antenna. See Livingston at FIG. 5 and 7:58-64. As shown best in FIGS. 7A-B, the delivery of RF energy from each small "probe" is controlled by a MEMS switch configured as a cantilevered arm carrying a first contact **710** that moves up (as shown in FIG. 7A in the OPEN position) and down (as shown in FIG. 7B in the DOWN position) over a second contact **703**. See Livingston at 10:26-34. In the present invention, on the other hand, the phase shifter includes a wiper arm that moves a trace contact along a transmission media segment carried on a backplane while maintaining electrical communication between the trace contact and the transmission media trace, as shown below in claims 1 as amended:

> 1. (currently amended) A phase shifter, comprising:
>
> a backplane carrying a transmission media trace;
>
> a wiper arm pivotally attached to the backplane and carrying a trace contact that is in electrical communication with the transmission media trace;
>
> ***an actuator for pivoting the wiper arm with respect to the backplane to move the trace contact along the transmission media trace while maintaining electrical communication between the trace contact and the transmission media trace;***
>
> a signal conductor in electrical communication with the trace contact; and
>
> ***a cantilever shoe including a trace contact biasing element configured to bias the trace contact toward the transmission media trace while the trace contact moves along the transmission media trace.***

Applicant submits that Livingston does not disclose or suggest a phase shifter that includes a wiper arm that moves a trace contact along an underlying transmission media trace while maintaining electrical communication between the trace contact and the transmission media trace and a cantilever shoe that biases the trace contact toward

the transmission media, as recited in claim 1, as amended. Therefore, Applicant submits that claim 1, as amended, is patentably distinct from Livingston.

In recognition of the fact that the trace contact carried by the wiper arm could travel along the backplane during all or a portion of its travel so long as it moves into electrical communication with the transmission media trace, claim 11 recites the invention as follows:

> 29. (new) A phase shifter, comprising:
>
> a backplane carrying a transmission media trace;
>
> a wiper arm pivotally attached to the backplane and carrying a trace contact;
>
> ***an actuator for pivoting the wiper arm with respect to the backplane to move the trace contact along the backplane and in electrical communication with the transmission media trace***;
>
> a signal conductor in electrical communication with the trace contact; and
>
> ***a cantilever shoe including a trace contact biasing element configured to bias the trace contact toward the backplane while the trace contact moves along the backplane***.

Again, Applicant submits that Livingston does not disclose or suggest a phase shifter that includes a wiper art that moves the trace contact along a backplane and a cantilever shoe that includes a trace contact that biases the trace contact toward the backplane and in communication with a transmission media trace carried by the backplane while the trace contact moves along the backplane, as recited in claim 29.

More specifically, the part of Livingston relied upon in the Official Action generally describes a type of MEMS switch module disposed at or within antenna apertures to interleave and switch multiple transmit and receive functions directly at the antenna apertures. Livingston at 8:20-67. This is to provide an antenna array that can send and receive RF signals over large bandwidths, and specifically to support multiple band, wide scan and multiple channel capabilities in a single antenna array. The MEMS switches are used with long, non-resonant TEM slots that form the antenna.

See Livingston at 3:55-67. Each switch is used to selectively couple RF energy from an antenna feed located on one side of an adjacent slot aperture, across the opening of the slot aperture, to the other side of the adjacent non-resonant slot aperture. The non-resonant slot aperture is formed of an opening in a metal layer, in which the MEMS switch is placed, with the opening having a length and a width to form a non-resonant slot. The selective coupling occurs depending on whether the switch is in an open or closed position. See Livingston at 4:18-40. The switch, when closed, connects an RF feed transmission line to ground, thus resulting in RF energy being coupled across the radiating slot and radiated by the radiating slot. See Livingston at 9:27-32.

FIGS. 6 and 7A-B of Livingston illustrates, with **621** being the radiating slot, **700** being the MEMS switches disposed within the slot, **710** being the OPEN-CLOSED contact of the switch that opens or closes the signal path to allow, when in the CLOSED position, a signal on signal conductor **641** to be connected to the ground pad **613**, and by means of a via (not shown), to the ground plane **620**.

The switch is controlled by a DC bias signal applied to a DC bias pad **615** which connects to a switch bias pad **723** on the switch **700**. Application of a DC voltage causes the RF MEMS switch to close, allowing current to flow across the TEM slot and thus controls the antenna's radiation of RF energy through the switch because of its placement within the antenna slot. See Livingston at 9:33-42.

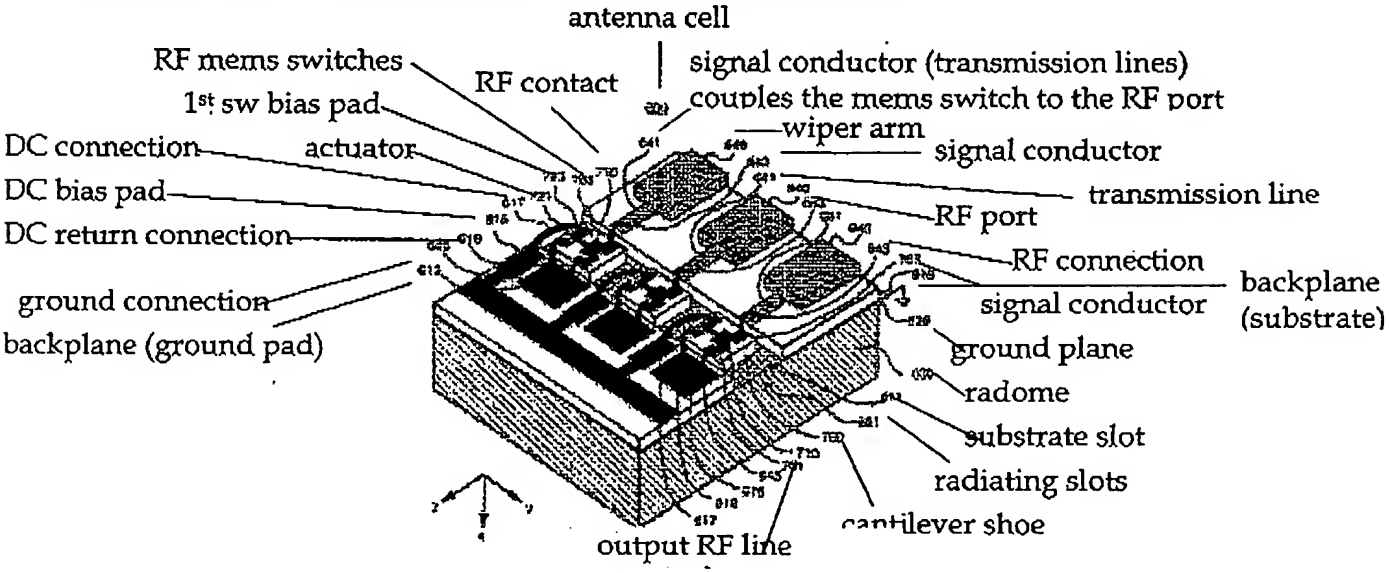


FIG. 6

In contrast, the present invention is for a wiper-type phase shifter that includes an arm that rotates like a windshield wiper, and is not an on-off switch that moves up and down from two positions, ON and OFF, or OPEN and CLOSED. The rotatable wiper-like arm moves over continuously varying positions defined by two extreme ends of the wiper arm movement along a backplane or along a transmission media trace carried on the backplane, not in an up and down movement between two positions, ON and OFF. The wiper arm is constructed as a cantilever shoe, pivotally secured at one end for ease of rotation, and with a biasing element at its opposite end to bias the trace contact that is carried on the cantilever shoe to ensure good electrical contact with the transmission media trace.

FIG. 5 illustrates the wiper arm's rotational movement that can provide continuous and variable electrical contact coverage between end points B and C. The side views of FIGS. 6 and 7 show the cantilever structure with the pivitol support structures on the left side, and the biasing element used to make good electrical contact with the underlying transmission media trace on the right side.

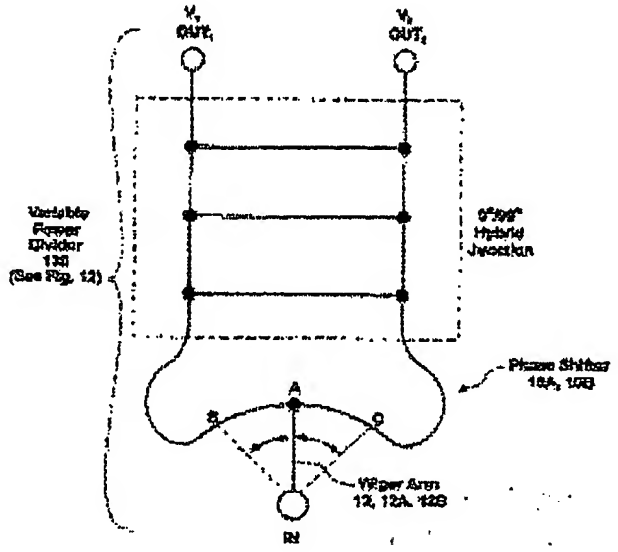


FIG. 5

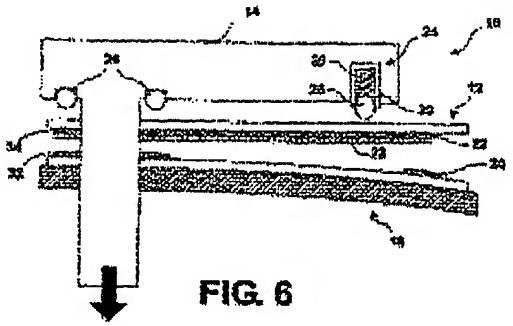


FIG. 6

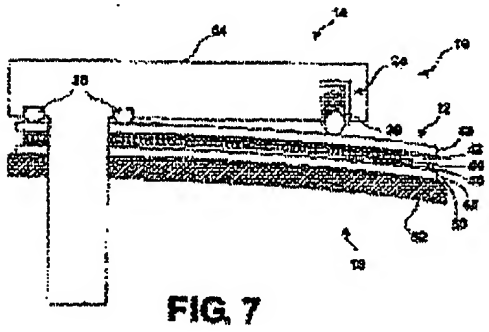


FIG. 7

The component parts of the wiper arm that includes the cantilever shoe on which is carried the trace contact is shown in FIGS. 8 and 9.

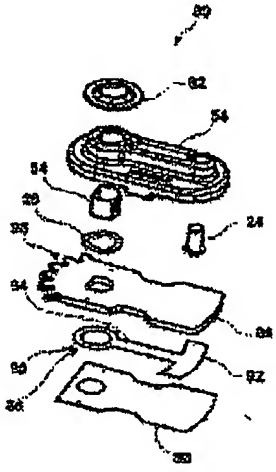


FIG. 8

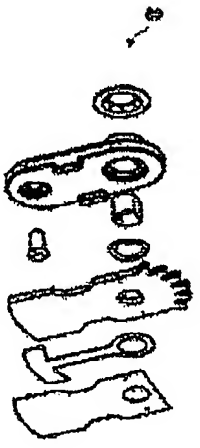


FIG. 9

Livingston does not use a cantilever shoe as defined in the present application. It does not use this or any other type of support structure in the form of a rotating arm that carries on it a conductive trace along an underlying transmission media trace or backplane. Livingston simply uses a wire conductor **643** that faces another wire conductor, **645** "ground connection", with the two conductors either being open or short circuited depending on whether the RF contact **710** is in an open or closed position. In Livingston, there is either no signal flow (switch OPEN) or the signal is shorted to ground (switch CLOSED) whereby the current flowing through the switch in the slot of the slot antenna causes the antenna to radiate.

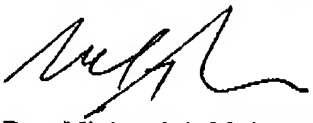
It should also be appreciated that the phase shifter of the present invention can be deployed as a stand alone phase shifter that need not be implemented as part of the radiating structure of a slot of an antenna, as in Livingston. The phase shifter of the present invention, by means of its uniquely designed rotating wiper arm, varies the phase of signals outputted from the phase shifter and those phase-shifted signals can be used to provide a variable phase shifted signal for any purpose. For example, the output signals of the phase shifter could be delivered to further signal processing circuitry, such as an amplitude control module. Or they could be delivered directly to one or more antenna elements, such as dipoles, patches, monopoles, yagis, etc. that are part of an antenna system. They could also be delivered to other non-antenna circuits to perform functions that vary based on the phase of the signal. In this regard, the invention's phase shifter can be deployed as a stand-alone component that, unlike Livingston, does not itself radiate, and may or may not have its outputs fed directly to antenna elements, depending on the particular choice of application.

These fundamental differences are to be expected since the subject matter of Livingston is an interleaved phased array antenna using MEMS switches, whereas the subject matter of the present application is for a wiper-type phase shifter with a cantilever shoe. Livingston is not concerned with a phase shifter; it does not use any wiper-type movement; and it does not use any type of cantilever shoe to bias a trace contact as it moves along an underlying transmission media segment or backplane. Accordingly, Livingston cannot establish a *prima facie* case of obviousness because it does not show or suggest every element of the claimed invention. MPEP § 2143.03.

CONCLUSION

It is believed that the preceding remarks are completely responsive to the First Official Action mailed January 24, 2006, and that the claims are in condition for allowance. If the Examiner believes that there are any issues that can be resolved by a telephone conference, or that there are any informalities that can be corrected by an Examiner's amendment, please call Mike Mehrman at (404) 497-7400.

Respectfully submitted,



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